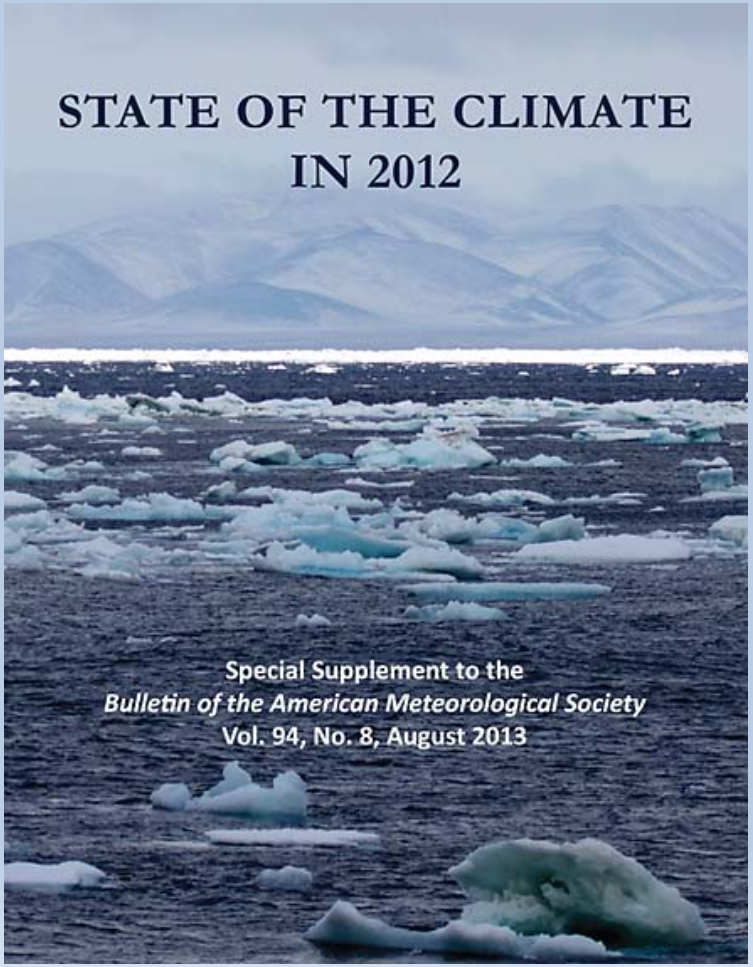


State of the Climate in 2012

Kathryn Sullivan, Ph.D, Acting Under Secretary of Commerce for Oceans and Atmosphere and NOAA Administrator

Thomas R. Karl, L.H.D., Director, NOAA's National Climatic Data Center, and Chair of the Subcommittee on Global Change Research

Jessica Blunden, Ph.D., Scientist, ERT Inc., Climate Monitoring Branch, NOAA's National Climatic Data Center

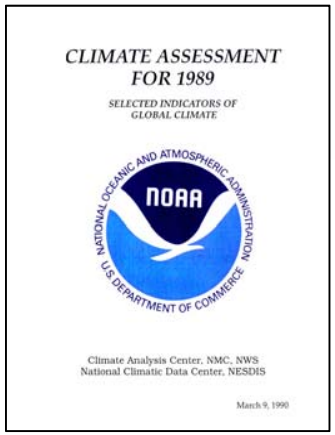
Kate Willett, Ph.D., Senior Scientist, Met Office Hadley Centre

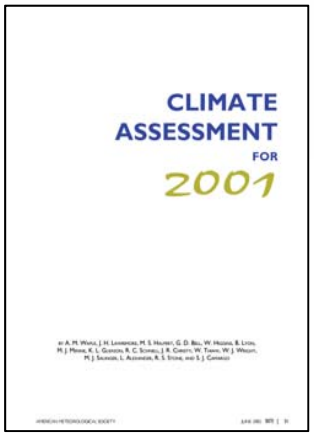
Jackie Richter-Menge, Research Civil Engineer, U.S. Army Corps of Engineers, Cold Regions Research and Engineering Laboratory

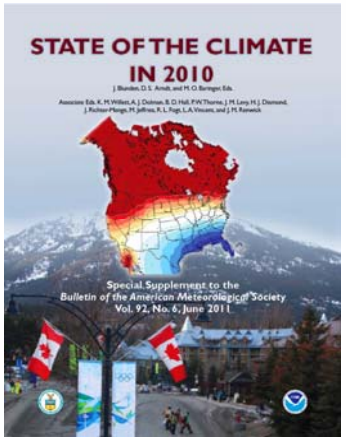
What is the Importance of this Report?

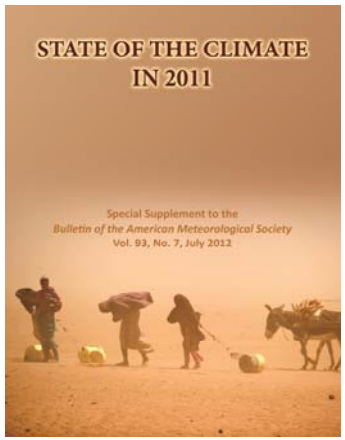
- Surveys the changing state and behavior of the physical climate system every year—intended to be an annual "score card"
- Brings together information about the many parts of the climate system into one single document
- Does not provide attribution or contain forecasts, scenarios, or projections
- Provides reference material for understanding science and effects of climate on economic, social, and natural systems

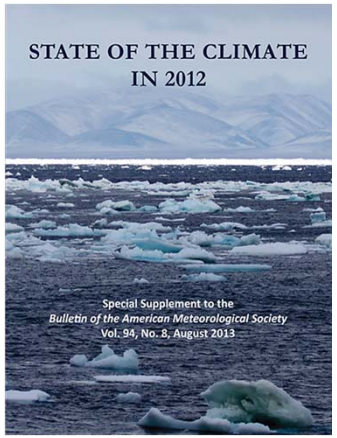
This is the 23rd annual State of the Climate report



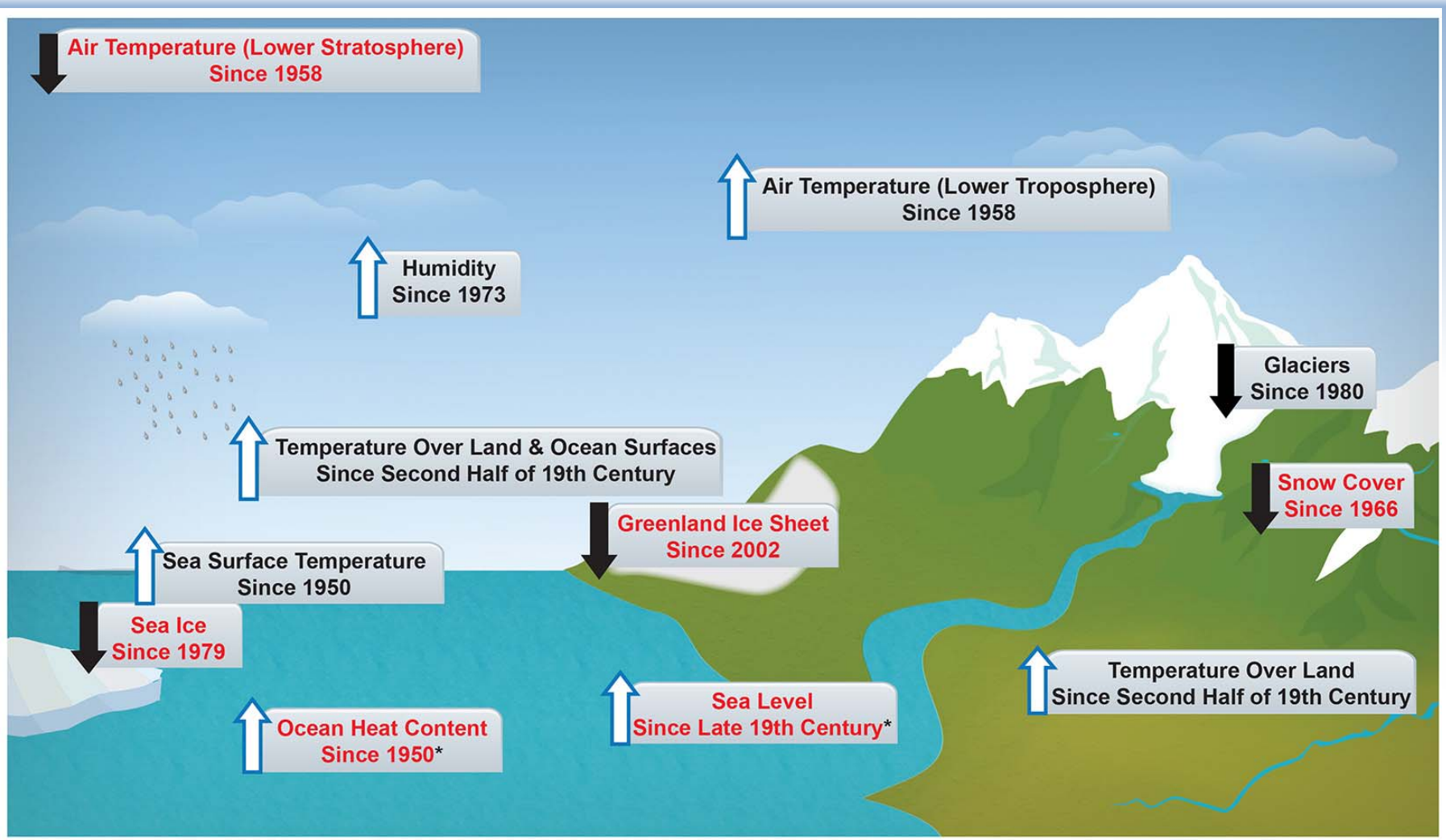








2012: Broad Monitoring of Climate System



--Red indicates record or near-record levels
*In report, analysis from 1993-2012

Who Puts the Report Together?

It takes more than a village to understand Earth's climate system and the impacts that weather and climate have around the world.

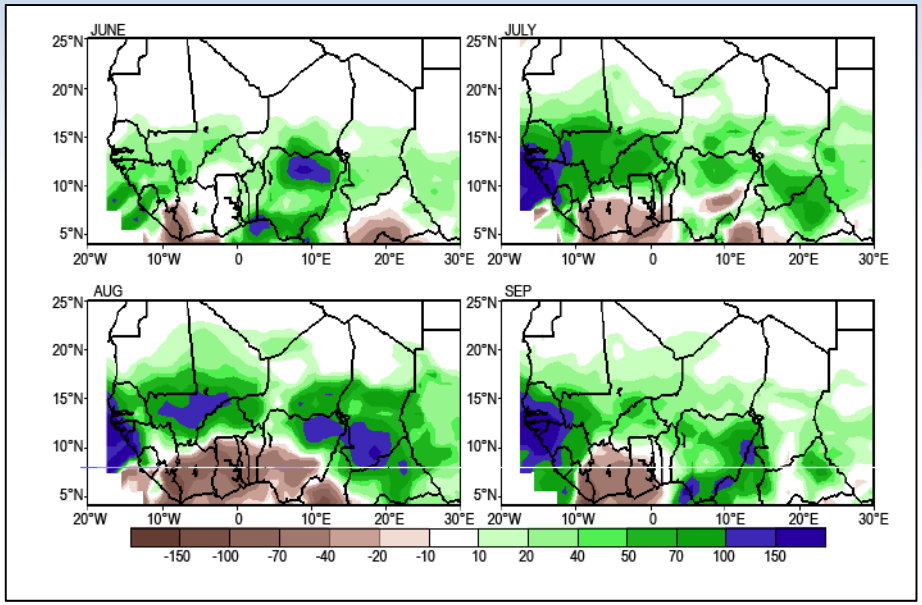
Many scientists from many disciplines contribute to fitting the pieces together.

Major Components of the Report

Includes country summaries of the annual climate for more than **120** countries and territories across the globe

Summaries include:

- **Temperature**
- **Precipitation**
- **Notable climate events**
  - Climatological impacts of extreme or unusual weather events such as droughts, flooding, heat waves, or cold snaps



Precipitation information for the Sahel during June–September 2012. The region had its wettest rainfall season in the past half century.

Major Components of the Report

Chapters describe various climate indicators and other climate phenomena

Global Climate

- Temperature
- Hydrological Cycle
- Atmospheric Circulation
- Earth's Radiation Budget
- Atmospheric Composition
- Land Surface Properties

Global Oceans

- Sea Surface Temperature
- Heat Content and Fluxes
- Salinity
- Ocean Currents
- Sea Level
- Global Ocean Carbon Cycle

The Tropics

- El Niño / Southern Oscillation
- Tropical Cyclones
- Intertropical Convergence Zones
- Atlantic Multidecadal Oscillation
- Indian Ocean Dipole

The Arctic

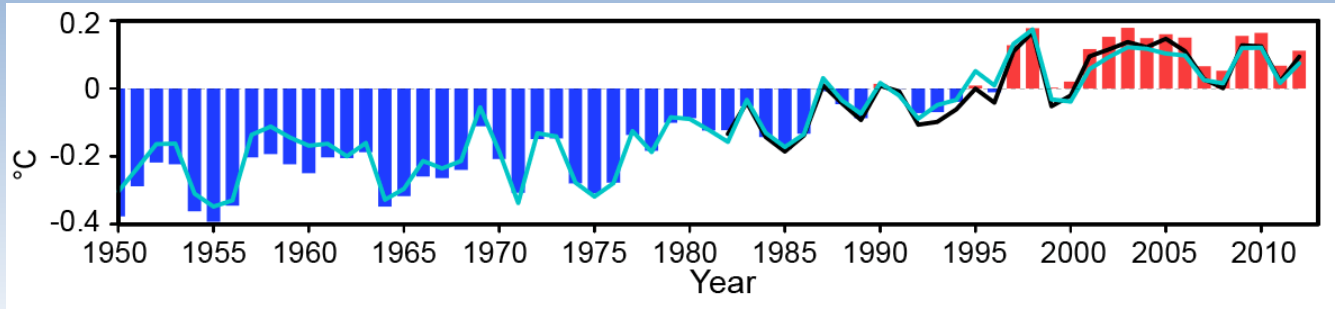
- Atmosphere
- Ocean
- Sea Ice
- Land
- Greenland

Antarctica

- Circulation
- Weather Observation
- Precipitation
- Sea Ice
- Ozone Depletion

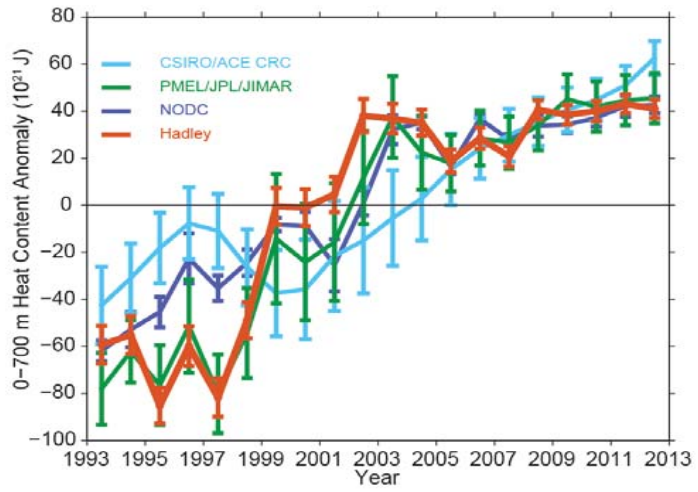
2012: Trends Continue in the Oceans

Global Ocean Surface Temperature



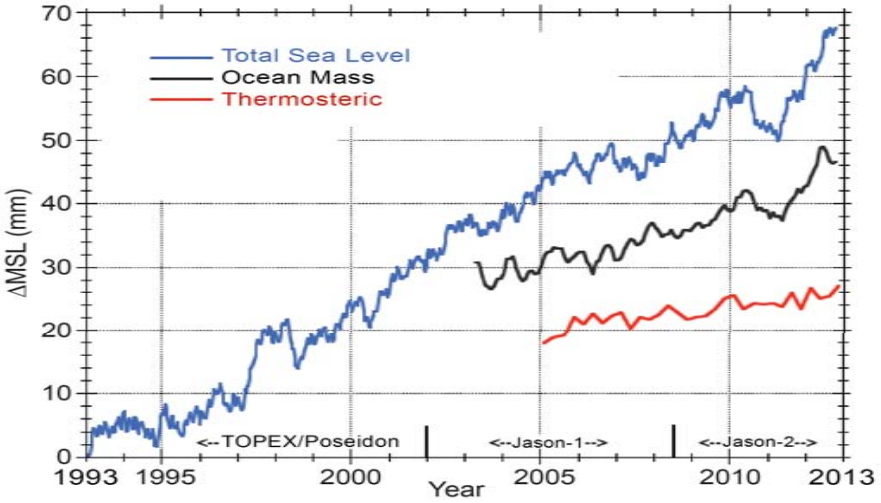
Global average ocean surface temperature was higher than the 1981–2010 average and has been for at least a decade.

Upper Ocean Heat Content



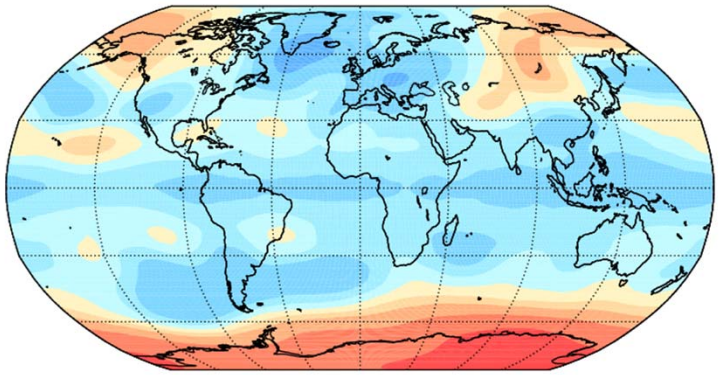
Heat content in the upper 2,300 feet of the ocean remained near record high values in 2012. Overall increases were also observed in the deep ocean below.

Sea Level Rise

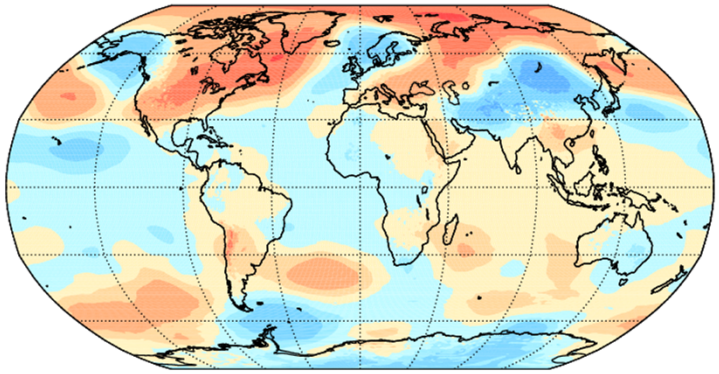


Average global sea level reached a record high in 2012. Total sea level has increased at an average rate of 3.2 mm per year since 1993.

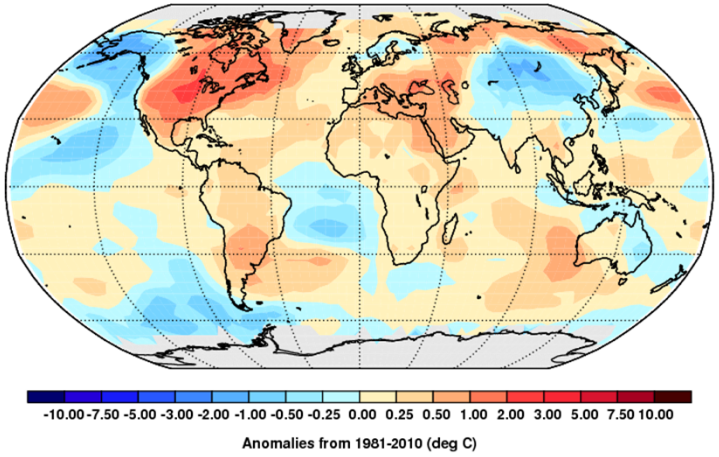
Lower Stratospheric Temperature



Lower Tropospheric Temperature



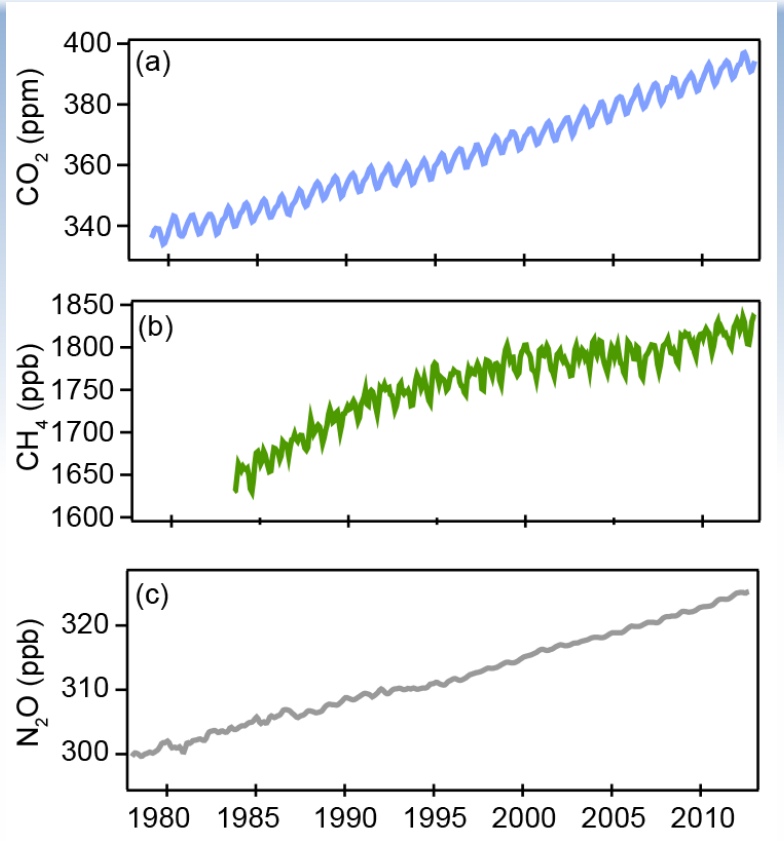
Surface Temperature



Continued warmth at the surface and in the troposphere with continued cold in the stratosphere

- Lower stratospheric temperatures for 2012 were record coldest to 8th coldest since records began in 1979 (satellites) and 1958 (radiosondes)
- Lower tropospheric temperatures for 2012 were 8th to 11th warmest since satellite and radiosonde records began
- Surface temperatures for 2012 were 8th to 9th warmest since records began in mid-to-late 1800s

Continued Increase in Greenhouse Gases

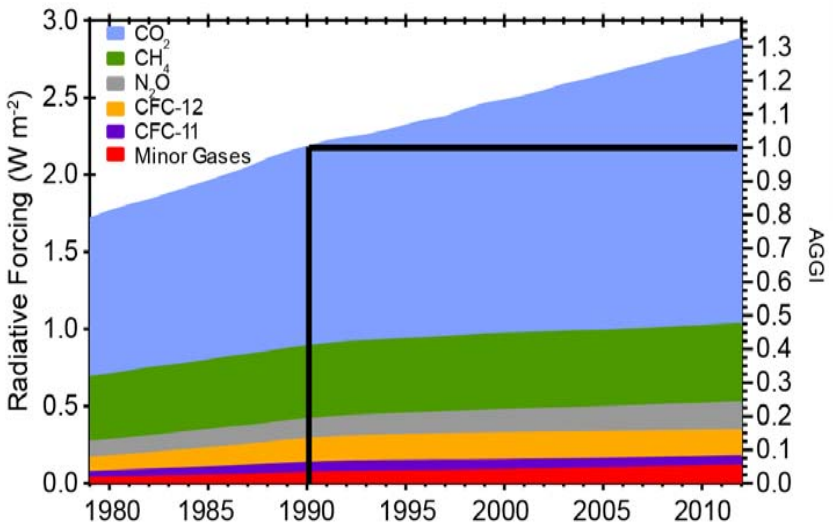


Global mean carbon dioxide (CO_2) reached 392.6 ppm, a 2.1 ppm increase from 2011

Global mean methane (CH_4) reached 1808.5 ppb, a 5.1 ppb increase since 2011

Global mean nitrous oxide (N_2O) reached 325 ppb, a 0.8 ppb increase since 2011

Additional radiative forcing from greenhouse gases above preindustrial times is now 2.88 W m^{-2}, a 32% increase since 1990

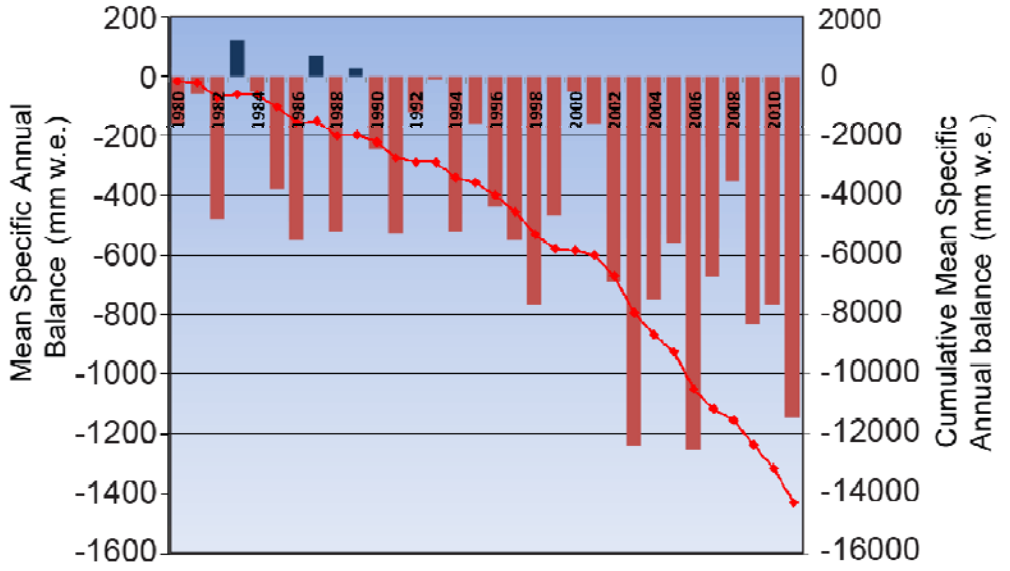


Continued Signals of a Warming World in the Cryosphere


Photo Credit: Vladimir E. Romanovsky

There were record warm permafrost temperatures in the Alaskan Arctic and Canadian Archipelago alongside ongoing warming and increasing Active Layer Thickness.

Preliminary data suggests that 2012 will be the 22nd consecutive year of negative glacier mass balance.



Arctic Amplification of Global Warming

Temperature anomaly (Celsius) for October 2011–September 2012 relative to the 1981–2010 average

Temperature anomaly (Celsius) for 2001–2011 relative to 1971–2000

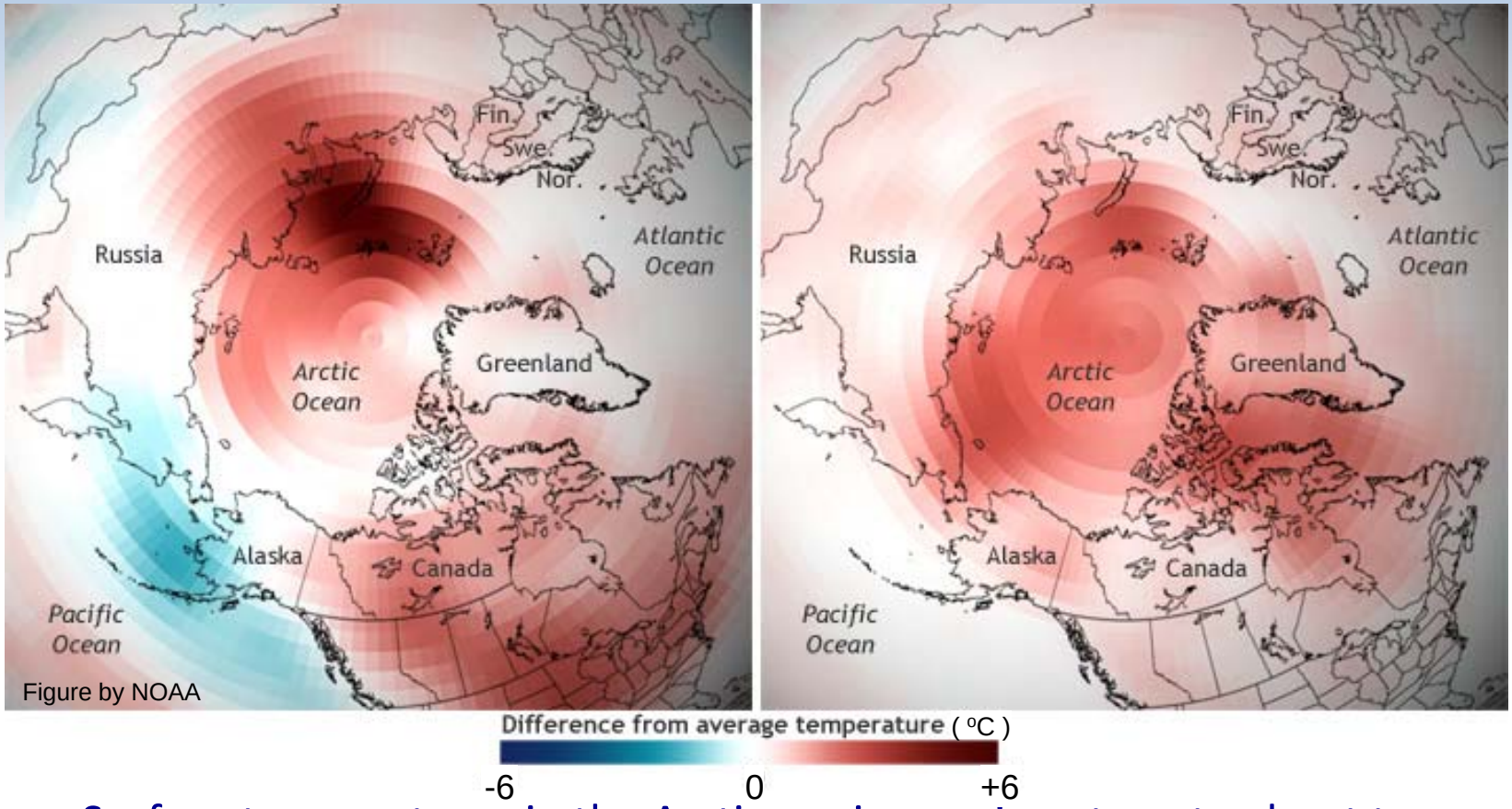


Figure by NOAA

Surface temperatures in the Arctic are increasing at a rate about two times faster than the rest of the world.

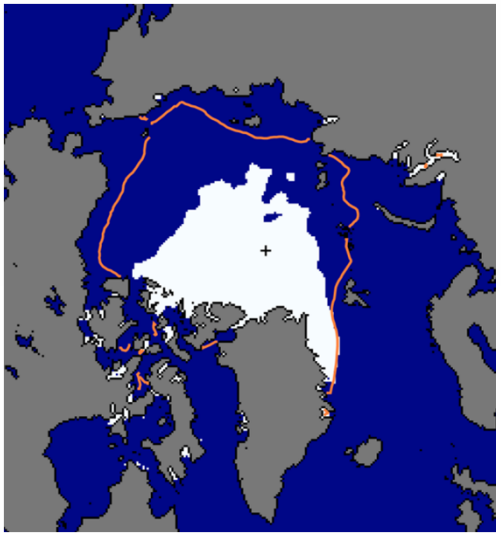
2012: Arctic Ice

Numerous record melt events observed for:

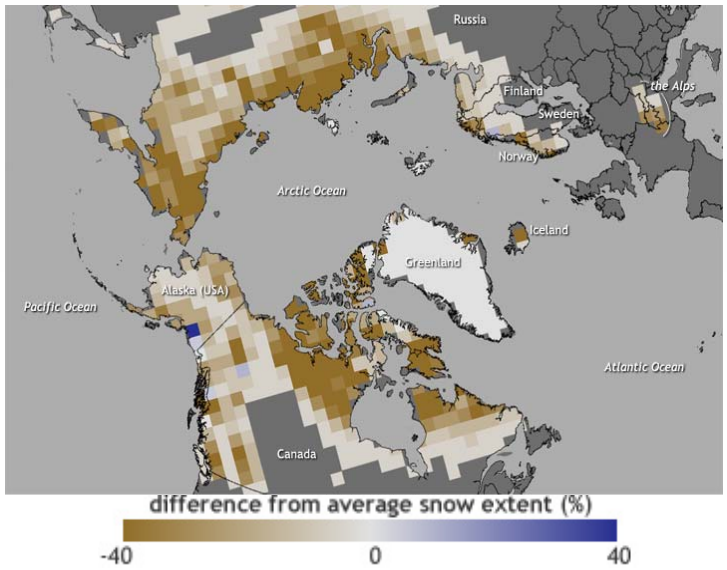
- Permafrost temperatures
- Spring snow cover extent
- Summer sea ice cover
- Greenland ice sheet
- Lake ice break-up
- Canadian Arctic glaciers and ice caps

Many of these events were related to a strong and persistent southerly airflow into the Arctic in spring and summer.

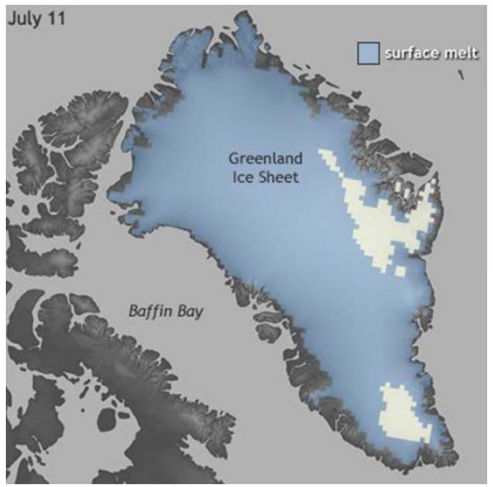
Sea ice extent on 16 September 2012



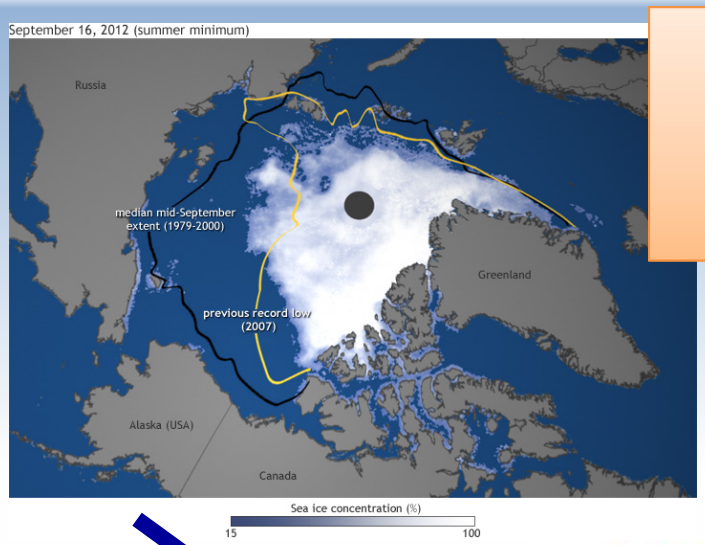
June 2012 snow extent anomaly on land relative to 1971–2000



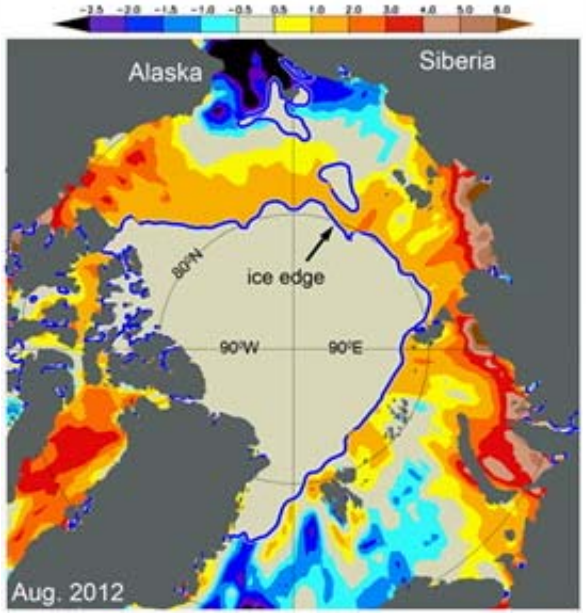
Rare, near-ice sheet-wide surface melt event on 11 July 2012

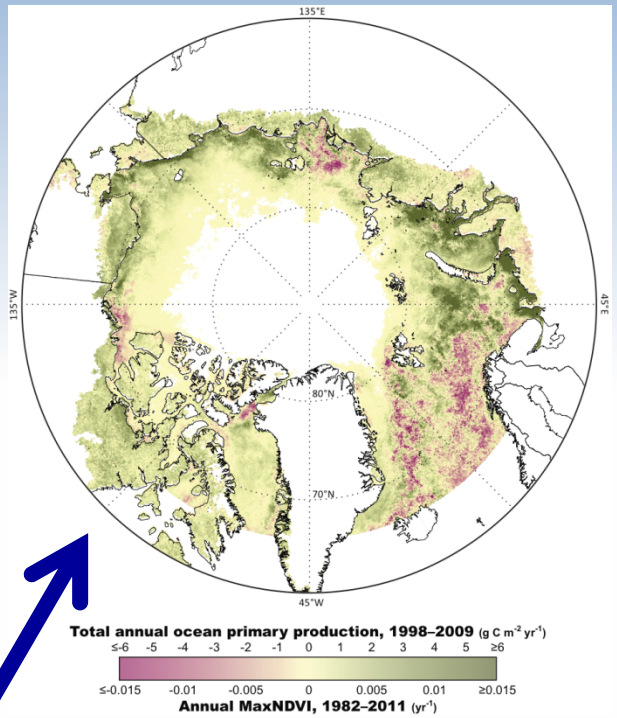


Linkages in the Arctic System



Drastic and persistent reduction in extent of summer sea ice cover in coastal margins



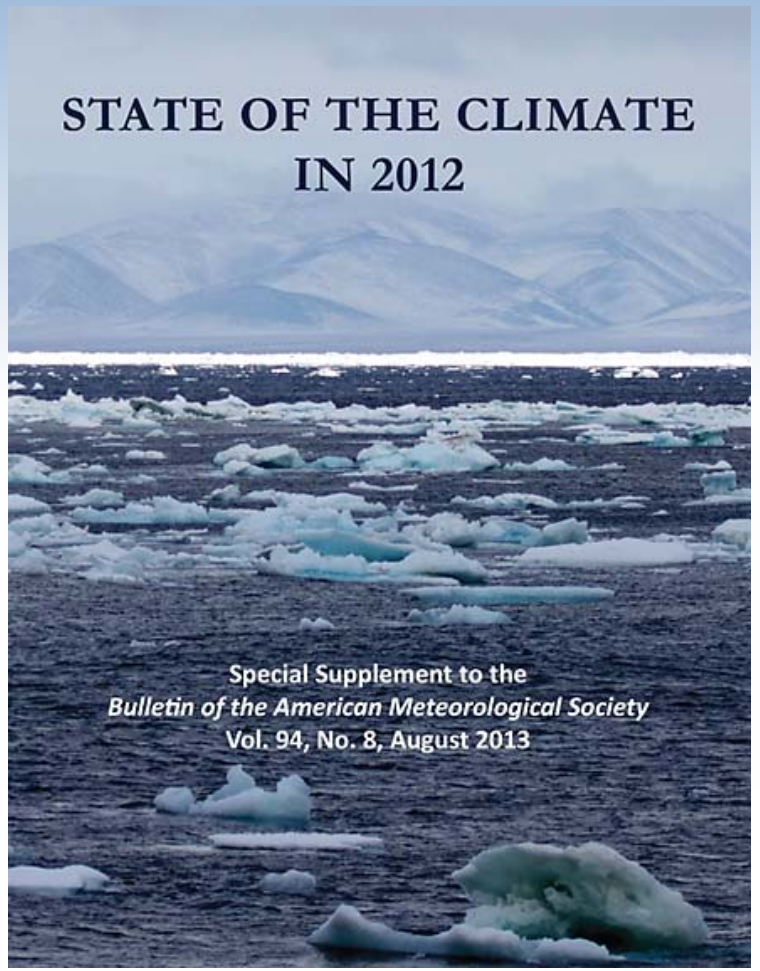


Warming of ocean surface in regions of open water

Increase in tundra vegetation and ocean primary productivity in coastal regions

State of the Climate in 2012

- The 2012 annual global temperature across land and ocean surfaces was among the 10 warmest years on record
- Several important indicators set new records or were near record levels during the year:
  - Greenhouse gas levels
  - Lower stratospheric temperatures
  - Ocean heat content
  - Sea level rise
  - Late spring Northern Hemisphere snow cover extent
  - Arctic minimum sea ice extent
  - Permafrost temperatures
- The Arctic continued to warm faster than the rest of the globe. Impacts from the warmth were unprecedented in 2012



For More Information

Link to Full Report and Today's Presentation:

- http://www.ncdc.noaa.gov/bams-state-of-the-climate/2012.php

Report Highlights:

- http://www.climate.gov/news-features/understanding-climate/state-climate-2012-highlights

NOAA's National Climatic Data Center: www.ncdc.noaa.gov

U.S. Army Corps of Engineers, Polar Research and Engineering Lab: http://polar.crrel.usace.army.mil/

UK MetOffice-Climate: http://www.metoffice.gov.uk/climate-change

Climate Portal: www.climate.gov

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